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EXAMINER	
INGHAM, JOHN C	

ART UNIT	PAPER NUMBER
2814	

DATE MAILED: 10/13/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/517,529	UNNO, AKIRA	
	Examiner	Art Unit	
	John C. Ingham	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 December 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-11 and 14-20* is/are rejected.

7)☒ Claim(s) *12 and 13* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 December 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *8/22/05*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because they (a) contain items not referred to in the specification and (b) are missing items that are referred to in the specification. In Figure 11, item 408' is not labeled, although it is referred to in the specification on page 50, line 4. Item 406 in Figure 11 is referred to as a "drain" on page 50, yet exists on both sides of the gate (402) and comes in contact with the source (405). Also, none of the items in Figure 13 are referenced in the specification (508-510, 512, 514, 516, 518, 526, 528, 529). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the

examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

2. The disclosure is objected to because of the following informalities: page 52 refers to items in Figure 11 that are defined differently on page 50. Item 415 is defined on page 50 (line 7) as "liquid crystal composition", but referred to on page 52 (line 5) as "opposed electrode". Item 414 is defined as "opposed electrode" on page 50 (line 7), but referred to as "glass substrate" on page 52 (line 6). Item 416 is defined as "a gap" on page 50 (line 8), but referred to as "liquid crystal composition" on page 52 (line 19).

Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims **1-16** are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. With regards to claim 1, line 7 recites the limitation "an island-shaped protrusion layer". It is unclear whether the applicant intends that the protrusion layer is "island-shaped", or whether the layer is one of "island-shaped protrusions". The claim is interpreted to mean that the layer is characterized by having island-shaped protrusions upon it.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims **1, 2, 11, 19, and 20** are rejected under 35 U.S.C. 102(b) as being anticipated by Baumbach.

With regards to claim **1**, Baumbach discloses in Figure 9 an organic semiconductor element comprising a gate electrode (51), a gate insulating layer (52), an organic semiconductor layer (58), source/drain electrodes (56) and a protective film (60), which are provided on a surface of a substrate (50), wherein an island-shaped protrusion layer (53) having dispersed and island-shaped protrusions (three instances of item 54) with a low surface energy (protrusions 54 made of polyimide, col 5. ln. 31-33) is provided in contact with the organic semiconductor layer (contact made through layer 57, also polyimide, col. 5 ln 41-42).

With regards to claim **2**, Baumbach discloses in Figure 9 the organic semiconductor element according to claim 1, wherein between the gate insulating layer (52) and the organic semiconductor layer (58) is provided the island-shaped protrusion layer (53) having the dispersed and island-shaped protrusions (three instances of 54) with the low surface energy (protrusions made of polyimide, col. 5 ln 31-33).

Regarding claim **7**, Baumbach discloses in column 5 lines 31-33 that the protrusions are made of polyimide.

Regarding claim **11**, Baumbach discloses in column 5 lines 31-33 that the protrusions with the low surface energy are made of polyimide.

With regards to claim **19**, Baumbach discloses in column 2, lines7-10 that the invention according to claim 1 may be used for an active matrix type display.

Regarding claim **20**, Baumbach discloses in column 2, lines 7-10 that the invention according to claim 1 may be used as an IC information electronic tag.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims **3-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baumbach. Baumbach discloses the organic semiconductor element according to claim

1, but does not teach the four rearrangements of layers recited in claims 3-6. However, regardless of the layer order, the organic material acts as the active layer. It would have been obvious to one of ordinary skill in the art at the time of the invention to change the order of layers to provide different means to make contact with the source, drain, and gate electrodes. See *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950).

10. Claims **1, 2, 7-10, and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson in view of Parikh.

Regarding claim **1**, Jackson discloses in Figure 4 an organic semiconductor element comprising a gate electrode, a gate insulating layer (gate dielectric), an organic semiconductor layer (90°C pentacene), and source/drain electrodes. Jackson does not disclose the protective film nor an island-shaped protrusion layer having dispersed and island-shaped protrusions with a low surface energy provided in contact with the organic semiconductor layer, but does disclose an OTS layer between the gate dielectric and organic layer.

It would have been obvious to one of ordinary skill in the art at the time of the invention to add the protective film to the structure recited by Jackson. Motivation to do so includes the necessity of a passivation layer covering sensitive electronic components, well known in the art.

Parikh discloses in the abstract and first paragraph of the introduction a description of an OTS layer molecular structure. Namely, in lines 10-12 of the abstract Parikh discloses that the OTS film exhibits closely spaced islands, arranged vertical to

the substrate surface, with a coverage dependant on temperature. It would have been obvious to one of ordinary skill in the art at the time of the invention to use the teachings of Parikh to describe the island structure of the layer between the gate dielectric and organic layer of an OTFT. Motivation to use the teachings of Parikh arises from the desire in the organic transistor art for highly organized films, which grow on the OTS layer as described. Motivation also arises from the description of control over the surface energy depending on temperature, as disclosed in the abstract and on page 7581 (section 3.2 paragraph 2).

The combination of teachings from Jackson and Parikh (plus the well known passivation layer) results in a structure with a gate electrode, gate insulating layer, OTS film with island-shaped protrusions, organic layer, source/drain electrodes, and protective film on a surface of a substrate. The island-shaped protrusion layer resides between dielectric and organic layers, satisfying the limitation that the island-shaped protrusion layer is provided in contact with the organic semiconductor layer.

Regarding claim **2**, Jackson in view of Parikh disclose the organic semiconductor element according to claim 1, wherein between the gate insulating layer and the organic semiconductor layer is provided the island-shaped protrusion layer (OTS layer of Jackson as described by Parikh) having the dispersed and island-shaped protrusions with low surface energy.

With regards to claim **7**, Parikh discloses in Figure 1 that the surface energy of the OTS layer is dependent on preparation temperature, and the graph shows surface energy (surface tension) of the layer as below 30 dyne/cm.

Regarding claim **8**, Parikh discloses in Figure 2 that the proportion of the island-shaped protrusions dispersed in the island-shaped protrusion layer (film coverage) decreases as preparation temperature increases. Above 35°C, the coverage satisfies the limitation that the proportion of coverage is 10-95%.

With regards to claim **9**, Parikh discloses in the caption of Figure 2 that the figure is derived from a normalized film thickness of 26.2Å (2.62nm), satisfying the limitation that the height of the island-shaped protrusions is 0.2 to 150 nm.

Regarding claim **10**, Parikh discloses in column one on page 7586 (paragraph 4) that an average surface coverage of 90% results in close packed islands of 50 Å (5nm) width, satisfying the requirement that the average diameter of the island-shaped protrusions is 0.1 to 100 nm.

Regarding claim **14**, Jackson discloses in Figure 4 that the organic semiconductor layer is made of pentacene.

11. Claims **15 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson and Parikh as applied to claim 1 above, and further in view of Shi et al.

Regarding claim **15**, Jackson and Parikh disclose the organic semiconductor element according to claim 1, but do not disclose wherein the organic semiconductor layer has periodicity with respect to a surface normal direction of the gate insulating layer.

Shi et al. teaches in column 5 lines 2-5 that the organic material stacks with pi-electron overlapping aligned in the source to the drain direction. According to

applicant's specification, periodicity means a successive stacking of a single layer composed of pentacene molecules. It would have been obvious to one of ordinary skill in the art at the time of the invention to perform the above described stacking, since the alignment and stacking creates the highest mobility in the source to drain direction within the organic material (Shi, col 4 ln 55-57)

Jackson and Parikh disclose the organic semiconductor element according to claim 1, but do not disclose wherein the organic semiconductor layer is made of a film of a pentacene derivative with a C-axis orientation of 85% or more. Jackson does disclose that the pentacene layer be formed at a temperature of 90C.

Shi et al. teaches the interchangeable features of pentacene and pentacene derivatives in column 5 lines 19-21. Shi also discloses in column 5 lines 2-3 that the organic material is deposited on top of the orientation film. According to applicant's own specification, a pentacene derivative formed by deposition under a temperature range of 80C-180C will exhibit the claimed C-axis orientation. It would have been obvious to one of ordinary skill in the art at the time of the invention to have used a derivative of pentacene as a precursor to improve the well known insolubility of that organic material.

12. Claims **17 and 18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Jackson and Parikh, as applied to claim 1 above, and further in view of Bao.

With regards to claim **17**, Jackson teaches a production method of an organic semiconductor element, comprising providing on a surface of a substrate a gate

electrode, a gate insulating layer, an organic semiconductor layer, an OTS layer, and source/drain electrodes. As discussed above, it is well known in the art to provide a protective film, and Parikh teaches the creation of island-shaped protrusions with low surface energy on the OTS layer in contact with the organic semiconductor layer.

The combination of Jackson and Parikh does not disclose the production method wherein the island-shaped protrusions are formed by spin-coating or spray coating. However, as recited by Bao any organic materials can be processed by spin-coating, evaporation, etc (see lines 11-13 on page 1299). Motivation to use spin-coating techniques is due to the ease of this type of processing, though Bao does disclose that spin-coated films tend to have lower field-effect mobility (page 1300, paragraph 3). Using this method for deposition of the OTS layer satisfies the limitations of the claim.

Regarding claim **18**, Jackson discloses in Figure 4 that the organic semiconductor layer is formed on the island-shaped protrusion layer (after that layer has been formed according to the teachings of Bao above) under a heating condition of 90°C. This temperature satisfies the claim limitation that the organic semiconductor layer be formed under a heating condition of 60°C to 200°C.

Allowable Subject Matter

13. Claims **12 and 13** are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: prior art teaches a layer disposed between the gate dielectric and organic, which can be any one of materials OTS, polyimide, perfluoropolymer, and fluoroalkylsilane depending on whether the layer is an orientation layer, self-alignment layer, or polymeric layer. The art does not teach the formation of island-shaped protrusions, however, in any material but OTS.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kelley et al. discloses the reordering of the source/drain electrodes above and below the organic layer. Sugimura teaches the use of fluoroalkylsilane as a monolayer between the gate dielectric and organic.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John C. Ingham whose telephone number is (571) 272-0237. The examiner can normally be reached on M-F, 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

jci

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PRIMARY EXAMINER